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EXAMINER

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Appeal 2008-0533
Application 09/615,294
Technology Center 3700

Before: TERRY J. OWENS, JENNIFER D. BAHR and
STEVEN D.A. MCCARTHY, *Administrative Patent Judges.*

DECISION ON APPEAL

1

2 The Appellants appeal under 35 U.S.C. § 134 (2002) from the final
3 rejection of claims 4-8 and 10-18 under 35 U.S.C. § 102(b) (2002) as being
4 anticipated by Macy (U.S. Patent 5,522,249) or, in the alternative, under 35

1 U.S.C. § 103(a) (2002) as being unpatentable over Macy. We have
2 jurisdiction under 35 U.S.C. § 6(b) (2002).

3 We REVERSE.

4 The claims on appeal relate to methods for manufacturing tuning
5 forks. A preferred method manufactures a double-ended tuning fork
6 including a piece of piezoelectric material having a central body, a pair of
7 drive tines extending from one end of the central body and a pair of pickup
8 tines extending from the other end of the central body. (Spec. 4, ll. 3-9). A
9 tuning fork of this design may be used to sense a rate of rotation about an
10 axis of symmetry of the tines by driving the drive tines to oscillate in a plane
11 containing the axis of symmetry and then measuring electrical signals
12 induced by Coriolis stresses appearing in the material as the fork rotates.
13 (Spec. 1, ll. 4-13).

14 Small variations in the fabrication of the tuning fork may cause the
15 tines to oscillate asymmetrically, giving rise to an electrical error signal
16 referred to as a “quadrature error signal” because it is 90° out of phase with
17 the signal induced by the Coriolis stresses in the fork. (Spec. 1, l. 14 – 2, l.
18 2). The present specification asserts that a “conventional” method for
19 reducing this quadrature error signal is to deposit masses on the ends of a
20 pair of tines and then use a laser to remove a portion of the mass from one of
21 the tines. The specification states that the removal of mass from the end of a
22 tine subjects the tine to a torsional twist giving rise to a signal which may be
23 used to negate the quadrature error signal. (Spec. 2, ll. 3-11). One drawback
24 to this conventional method is that an imbalance between the masses at the
25 ends of a pair of tines may result in unwanted vibration of the tuning fork as
26 a whole as well as its surroundings. (Spec. 2, ll. 12-20).

1 As will become more apparent during the course of this opinion, the
2 primary issue in this appeal is whether Macy discloses or teaches
3 maintaining a balance in mass between the tines. Macy discloses a single-
4 ended tuning fork inertial sensor including a tuning fork formed of a single
5 piece of piezoelectric material chemically etched to form a body integral
6 with a single pair of tines. (Macy, col. 1, ll. 7-8 and col. 2, l. 51 – col. 3, l.
7 1). Drive electrodes and pickup electrodes are mounted on the surfaces of
8 the tines. (Macy, col. 3, ll. 41-42). Drive signals applied to the drive
9 electrodes cause the tines to oscillate in opposite directions. (Macy, col. 6,
10 ll. 26-36). The pickup electrodes detect “pickup signals” which may be
11 processed to obtain a DC voltage indicative of the rate of rotation of the
12 tuning fork about an axis of symmetry of the tines. (Macy, col. 6, ll. 37-61).

13 Claim 4 recites a method of manufacturing a tuning fork including the
14 step of “using balancing masses on the front surface of one tine and the rear
15 surface of the other tine to reduce quadrature displacement.” Even assuming
16 for purposes of this appeal that Macy’s drive and pickup electrodes are
17 “masses” within the meaning of claim 4, we agree with the Appellants (App.
18 Br. 5) that Macy’s electrodes are not used to maintain a balance in mass
19 between the tines.

20 Macy discloses mounting and trimming the electrodes of a single-
21 ended tuning fork so that the electrodes are “physically balanced to facilitate
22 separation of the pickup signals from the drive signals.” (Macy, col. 2, ll.
23 33-36). The reference suggests that mounting and trimming the electrodes
24 to approximate physical symmetry on the tines reduces error in the desired
25 rate signal by reducing residual charges on the pickup electrodes which
26 represent the drive strains. (Macy, col. 7, ll. 18-25). We agree with the

1 Appellants that one need not maintain a balance in mass between the tines
2 when mounting or trimming the electrodes to reduce these residual charges.

3 Macy would not have provided one of ordinary skill in the art reason
4 to maintain a balance in mass between the tines. The reference does not
5 teach or suggest any relationship between the masses of the electrodes and
6 the magnitude of error in the desired rate signal. Moreover, the reference
7 does not disclose preferred masses for the electrodes or suggest mounting
8 electrodes having masses sufficient to significantly affect the motions of the
9 tines. We agree with the Appellants (Appeal Br. 5 and 8) to the extent that
10 Macy's teachings do not convince us that one of ordinary skill in the art
11 would use electrodes on the front surface of one tine of Macy's tuning fork
12 and on the rear surface of the other tine to maintain a balance in mass
13 between the tines. On the record before us, the Appellants have shown that
14 the Examiner erred in rejecting independent claim 4 under section 102(b) as
15 well as alternatively under section 103(a).

16 Claim 5 recites "removing portions of the mass elements from the
17 front surface of one tine and from the rear surface of the other to reduce
18 quadrature displacement in the tines and maintain a balance in mass between
19 the tines." Claim 11 recites "trimming the balancing masses on opposite
20 sides of the drive tines to reduce quadrature displacement without affecting
21 mass between the drive tines." Claim 14 recites "removing substantially
22 equal amounts of the balancing masses from the front surface of one of the
23 tines and from the rear surface of the other tine to reduce quadrature
24 displacement in the tines and maintain the balance in mass between tines."
25 Claim 16 recites "removing substantially equal amounts of the balancing
26 masses from the front surface of one of the drive tines and from the rear

1 surface of the other drive tine to reduce quadrature displacement in the drive
2 tines and maintain a balance in mass between them.”

3 With respect to these claims, as with respect to claim 4, we agree with
4 the Appellants (*e.g.*, Reply Br. 1) that Macy does not disclose maintaining a
5 balance of mass between the tines and that the reference would have
6 provided one of ordinary skill in the art no reason to maintain such a
7 balance. On the record before us, the Appellants have shown that the
8 Examiner erred in rejecting independent claims 5, 11, 14 and 16 under
9 section 102(b) as well as alternatively under section 103(a). Since claims 12
10 and 13 depend from claim 11; claim 15 depends from claim 14; and claims
11 17 and 18 depend from claim 16, the Appellants have shown that the
12 Examiner also erred in rejecting those claims under section 102(b) as well as
13 alternatively under section 103(a). *In re Fritsch*, 972 F.2d 1260, 1266 (Fed.
14 Cir. 1992).

15 Claim 6 recites “adding mass elements to the front surface of one tine
16 and the rear surface of the other tine to eliminate¹ quadrature displacement
17 in the tines and maintain a balance in mass between the tines.” Once again,

¹ We note that Appellants amended claim 6 to substitute the word “reduce” for the word “eliminate” in an Amendment entered May 17, 2004. Claim 6 was reproduced with the final clause as shown in the text of this opinion in three subsequently-entered Amendments filed August 17, 2004; March 17, 2005; and June 24, 2005 as well as in the claims appendix of the Brief on Appeal. We would reach the same result in this appeal were the word “reduce” substituted for the word “eliminate.”

1 we agree with the Appellants (App. Br. 5 and 9) that Macy does not
2 teach or suggest the addition of mass elements to maintain a balance in mass
3 between the tines. On the record before us, the Appellants have shown that
4 the Examiner erred in rejecting independent claim 6 under section 102(b) as
5 well as alternatively under section 103(a).

6
7 Finally, claim 7 recites “adjusting the balancing masses on opposite
8 sides of the two tines to reduce quadrature displacement in the tines and
9 maintain a balance in mass between the tines.” We agree with the
10 Appellants (App. Br. 6 and 9) that Macy does not show or suggest adjusting
11 the balancing masses to maintain a balance in mass between the tines. On
12 the record before us, the Appellants have shown that the Examiner erred in
13 rejecting claim 7 under section 102(b) as well as alternatively under section
14 103(a). Since claims 8 and 10 depend from claim 7, the Appellants have
15 shown that the Examiner also erred in rejecting those claims under section
16 102(b) as well as alternatively under section 103(a). *Fritsch*, 972 F.2d at
17 1266.

18 Summarizing the conclusions which we draw from the record before
19 us, the Appellants have shown that the Examiner erred in rejecting claims 4-
20 8 and 10-18 under section 102(b) as being anticipated by Macy or, in the
21 alternative, under section 103(a) as being unpatentable over Macy.

1 DECISION

2 We reverse the Examiner's rejection of claims 4-8 and 10-18.

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4 REVERSED

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